THE MARKS MOSQUITO COLLECTION: LEGACY OF A LIFE'S WORK AND RESOURCE FOR THE FUTURE

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Abstract

The collection of Australasian mosquitoes accumulated by Elizabeth N. (Pat) Marks during her career is unique and undoubtedly the best of its kind in Australia. The history, size and diversity of the collection, its incorporation into the University of Queensland Insect Collection, and its value as a future information resource are discussed.

Introduction

During her lifetime, Elizabeth N. (Pat) Marks established herself as a world-renowned medical entomologist for her groundbreaking work in the classification and identification of mosquitoes. She wrote many taxonomic papers on mosquitoes of the Australasian region and described 38 new species. One of her legacies is the major mosquito collection that she assembled. Pat was an enthusiastic collector throughout her career. She collected widely in many parts of Australia (Fig. 1), especially Queensland and the Torres Strait islands, and in a number of Pacific countries, including Fiji. Between 1958 and 1979 she made five trips to New Guinea. She collected not only adults but, perhaps more importantly, thousands of larval specimens that were subsequently bred through to adults. Her mosquito breeding adds enormously to our knowledge of their biology and allowed recording of length of life stages and the preservation of both larval and pupal exuviae in addition to the adult. This material now comprises about 35,000 adult specimens and about 11,000 slide mounts of larval and pupal skins.

Fig. 1. Pat Marks processing her collections at camp on Hinchinbrook Island, 1984.

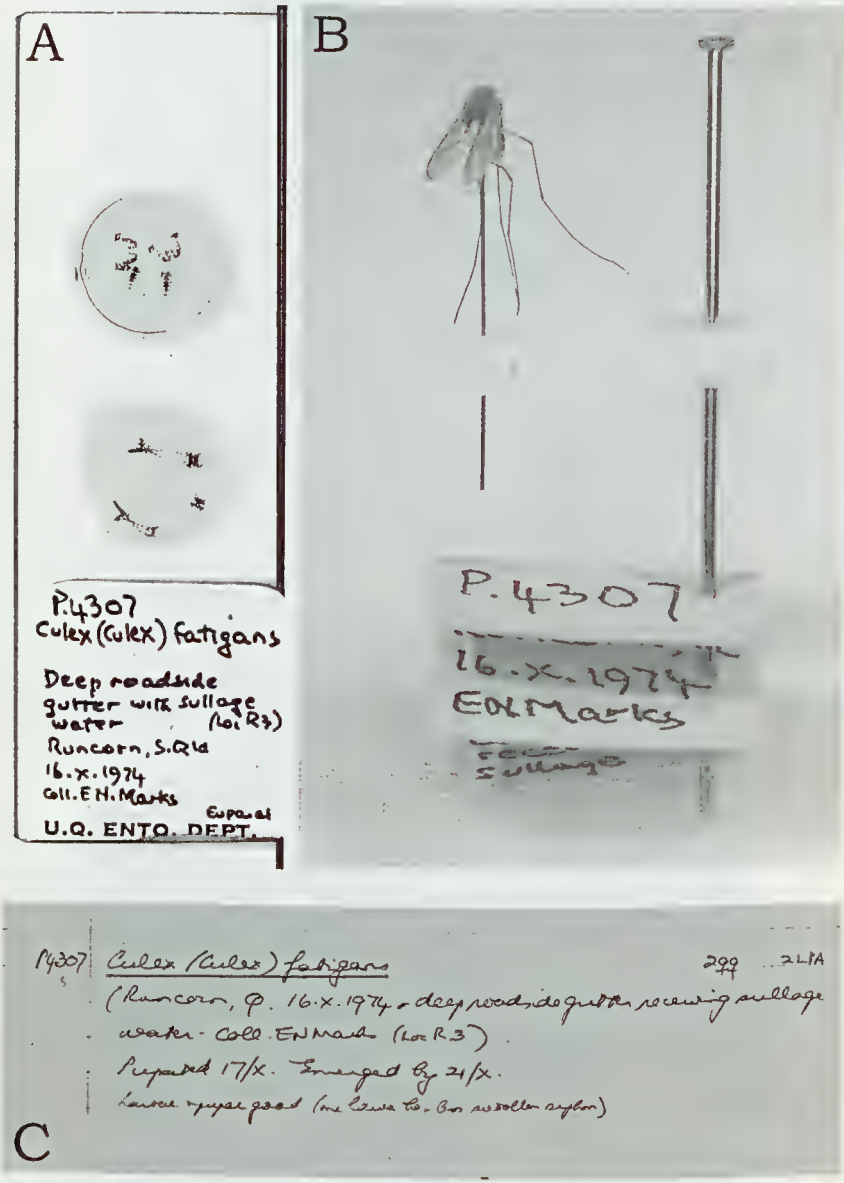


Fig. 2. Components of a link-bred specimen record for specimen P.4307 of *Culex fatigans* Wiedemann (= *C. quinquefasciatus* Say). (A) slide mount of larval and pupal skins; (B) pinned adult; (C) catalogue entry.

Figure 1 shows Pat during a collecting trip to Hinchinbrook Island, surrounded by typical untidiness and apparent chaos. However, in no way was untidiness reflected in the way she maintained records of her collections. Pat had a characteristic way of recording collection data, giving each individual specimen a code recorded in a field notebook. The same code number was allocated to each life stage so that all stages could be linked once material was stored (Fig. 2). The field notebooks contain an explanation of the code with locality and date and whatever other relevant data was available, for example, type of pond or stream, time of day, surrounding vegetation (Fig. 3). Thus the field notebooks add greatly to the value of the collected material.

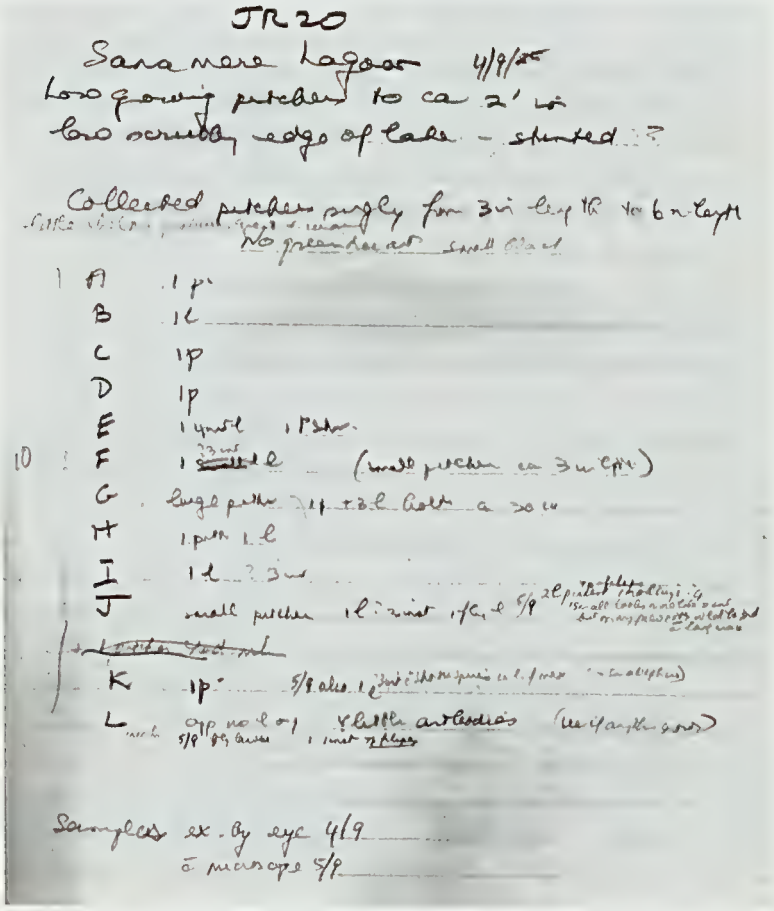


Fig. 3. Field notebook entry for specimens coded JR20.

In addition to the field notebooks, Pat created a set of catalogues. These are a neater, condensed, laboratory version of the rough field notes and also record the code number for each specimen. The first catalogue entries, for mosquitoes collected in 1943, are shown in Fig. 4.

Pat's commitment to collecting and work with the collection did not stop with her retirement in 1983 and she continued her research at the Queensland Institute of Medical Research for many years.

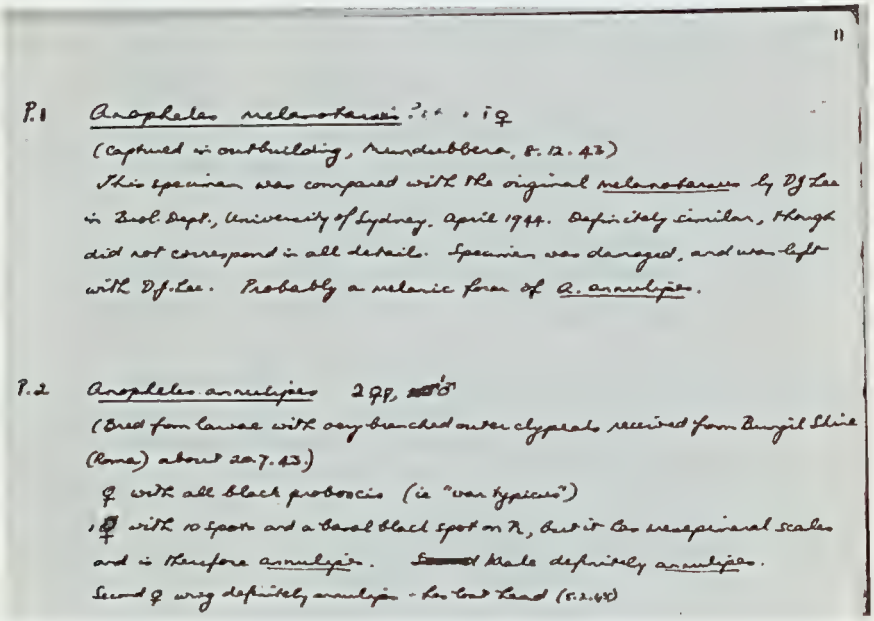
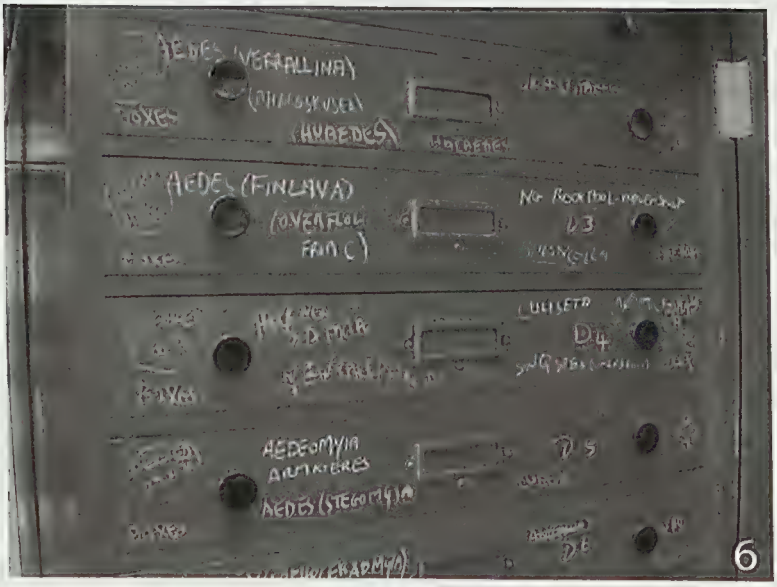


Fig. 4. The first two entries in the Marks specimen catalogue.

Incorporation into the University of Queensland Insect Collection

In 1994, at Pat's request, the bulk of the collection was incorporated into the University of Queensland Insect Collection (UQIC). Its mosquito collection was already one of the best in Australia, having received a large proportion of the mosquitoes from the School of Public Health and Tropical Medicine in Sydney when that institution was closed. The UQIC was thus the most appropriate collection to receive the Marks collection, being Queensland-based and already a centre for significant mosquito research. The collection arrived at the UQIC in a disorganized state. The pinned material was in an assortment of cabinets and boxes, and the 11,000 slides were in nine cabinets. However, most of the material was not curated. Most specimens had only a code number label (Fig. 5) and much of the identification of the pinned specimens was only indicated on the outside of the cabinets (Fig. 6).



Figs 5-6. (5) Adult specimen with only a code label. (6) Insect cabinet drawers with identifications on the outside.

For a year or so after 1994, Pat visited the UQIC irregularly to work on the collection. However, it became clear that she needed help to get the collection into a state that would allow its worth to be fully realised and made accessible to other researchers. Pat agreed, and in 1996-97 she donated $35,000 to the UQIC to fund a position for a year for a graduate research assistant, Jodie Cheesman, whose duties included: incorporating the Marks collection into the UQIC mosquito collection; updating nomenclature for each species and relabelling unit trays; identification, labelling and re-pinning of specimens; cross-referencing slide-mounted and pinned material; entering label data and names into a computer database.

Fig. 7. Pat Marks and Jodie Cheesman viewing part of the curated mosquito collection.

During the year, Jodie managed to fully curate and database about 35,000 adult pinned specimens. Pat and Jodie worked well together and Pat took great pleasure in seeing the collection transformed into a world-class taxonomic research facility (Fig. 7).

To date, the slide collection has been sorted but has not otherwise been curated nor databased. This is a great pity because, as long as it remains in its present state, we cannot easily know what material is in the collection. Many slides, like the adults, bear just the field code. Much of the collection's value lies in the many link-reared specimens - that is, the slide-mounted larval and pupal skins associated with their pinned adult (Fig. 2). If the slide collection was databased, these associations could be identified readily. Another remaining problem concerns the many specimens still on loan from other institutions. Some are easily identifiable and are in separate store boxes but all of the loan material needs to be removed and returned, a very time-consuming and expensive task.

The E.N. Marks contribution continues

Making the entire mosquito collection accessible to the wider community is an on-going objective of the UQIC. A list of all mosquito species in the UQIC is available on the Internet and can found at the UQ School of Integrative Biology's web site: *http://www.sib.uq.edu.au/insect-catalogue* under Diptera. This list allows external researchers to know what species are held and assists in requests for loans. Databasing continues and, to date, approximately 45,000 adult specimens have been databased. At present this database is available on-line to a limited number of researchers throughout Australia. The data are being used for quarantine and biosecurity purposes and specimens are being used to compare with quarantine interceptions.

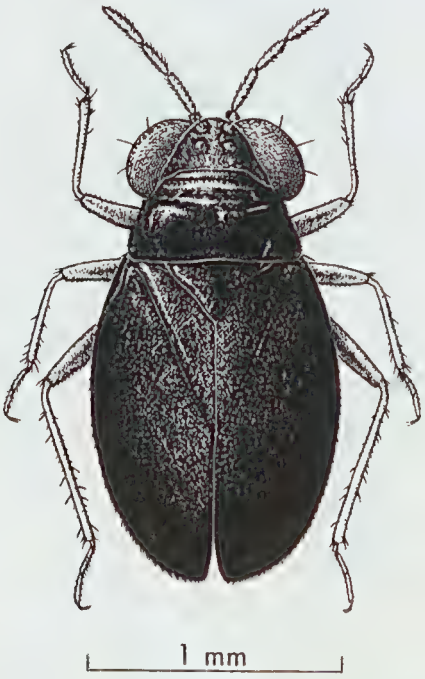
The Internet has opened up a number of ways to enhance the value of museum collections as information resources. For example, with the assistance of funds from Queensland Health, a web site about mosquito vectors of arboviruses has been developed using the UQIC material. This site can be viewed at *http://www.sib.uq.edu.au/index.html?page=32975*. It gives detailed information about the nine major vectors of arboviruses and 25 of the more common species in Queensland, plus others that could have vector potential. High quality photographs of the adults of each species can assist identification by comparison. In addition, based on UQIC specimen data, a distribution map, graphs of seasonality and biting times, and information about habitat, behaviour, vector ecology and bite prevention for each species can be studied. Much of this information is from the meticulous details recorded by Pat in her field notebooks. Another link takes the viewer to a table of mosquitoes and their associated arboviruses in Queensland.

UQ researchers have used the mosquito collection to develop computer-based interactive identification keys to Australian mosquitoes. As a result of these keys and the mosquito database, the collection has now become a valuable

resource for quarantine officers needing to identify and determine the distributions of mosquitoes that may pose a threat to human health. Medical entomology as a discipline continues to this day at UQ, with ongoing research projects focused on the mosquito vectors of malaria and dengue fever, and the development of novel approaches to control the diseases they transmit. The collection continues to contribute to this research.

Conclusion

Pat Marks was a dedicated and inspiring collector and researcher who, throughout her life, made major contributions to mosquito taxonomy, medical entomology and natural history. Information about the material she collected, and which is now incorporated into the UQIC, can be accessed via an online catalogue, specimen database and web pages about vectors of arboviruses. The collection is her legacy to future generations and she will continue to be remembered as an exceptional field collector of mosquitoes.



Corallocoris marksae (Woodward) (Hemiptera: Omaniidae), a bug collected by E.N. Marks beneath intertidal coral slabs on the Great Barrier Reef and named after her. Figure by Sybil Curtis, from CSIRO *Insects of Australia*.